

WE CLAIM:

1. A reflecting coupler, comprising:

a body having an aperture extending therethrough from a first side to a second side, an interior surface of the aperture being reflective, a first portion of the interior surface conforming to a two-dimensional (2-D) surface and a second portion of the interior reflective surface conforming to a three-dimensional (3-D) surface, the 2-D surface extending at least partially between the first and second sides of the body.

2. A coupler as recited in claim 1, wherein the first portion is disposed proximate the first side of the body and the second portion is disposed proximate the second side of the body.

3. A coupler as recited in claim 1, wherein the aperture defines a first aperture edge at the first side of the body, the first aperture edge being rectangular in shape.

4. A coupler as recited in claim 1, wherein the aperture defines a second aperture edge at the second side of the body and the second aperture edge has a circular shape.

5. A coupler as recited in claim 1, wherein the 2-D surface is an aspheric cylinder.

6. A coupler as recited in claim 5, wherein the reflecting surface proximate the first aperture edge conforms substantially to two intersecting aspheric cylinders.

7. A coupler as recited in claim 6, wherein a reflector axis is defined longitudinally along the center of the aperture between the first and second sides, and the aspheric cylinders are formed about the reflector axis.

8. A coupler as recited in claim 6, wherein the aspheric cylinders are parabolic cylinders.

9. A coupler as recited in claim 1, wherein a reflector axis is defined longitudinally along the center of the aperture between the first and second sides, and the 2-D surface is a surface comprises a surface formed with respect to a 2-D surface axis.

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10. A coupler as recited in claim 9, wherein the 2-D surface axis is coincident with the reflector axis.

11. A coupler as recited in claim 9, wherein the 2-D surface axis is non-coincident with the reflector axis.

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12. A coupler as recited in claim 11, further comprising a light emitting diode LED disposed at the first side of the body to emit light into the aperture, the LED having a first emitting surface non-perpendicular to the reflector axis, the 2-D surface axis passing through the first emitting surface.

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13. A coupler as recited in claim 12, wherein the 2-D surface defines a focus on the 2-D surface axis, the focus being positioned on the first emitting surface.

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14. A coupler as recited in claim 1, wherein the aperture defines a second aperture edge at the second side of the body, the second aperture edge conforming substantially to the 3-D surface.

15. A coupler as recited in claim 1, wherein the 3-D surface is a surface of revolution.

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16. A coupler as recited in claim 15, wherein a reflector axis is defined longitudinally along the center of the aperture between the first and second sides and the surface of revolution is a surface of revolution about the reflector axis.

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17. A coupler as recited in claim 15, wherein the surface of revolution is a paraboloidal surface.

18. A coupler as recited in claim 1, wherein, proximate the first side, the reflecting surface conforms substantially to four aspherically cylindrical surfaces and, proximate the second side, the reflecting surface conforms substantially to a surface of revolution.

19. A coupler as recited in claim 1, wherein the 2-D surface and the 3-D surface are interleaved.

20. An optical system, comprising:

a first reflecting coupler disposed generally along a reflector axis, and formed from a body having an aperture extending therethrough from a first side to a second side, an interior surface of the aperture being reflective, at least a first portion of the interior reflective surface conforming to a two-dimensional (2-D) surface and at least a second portion of the interior reflective surface conforming to a three-dimensional (3-D) surface, the 2-D surface extending at least partially between the first and second sides of the body;

a first light source disposed proximate the first side of the body so as to emit light into the aperture; and

a first optical fiber having an entrance face disposed proximate the second side of the body so as to receive light through the aperture from the first light source.

21. A system as recited in claim 20, wherein the light source is a light emitting diode.

22. A system as recited in claim 20, further comprising a plurality of light sources directing light into a plurality of respective optical fibers via a plurality of respective reflecting couplers, the plurality of light sources comprising the first light source, the plurality of optical fibers comprising the first optical fiber and the plurality of reflecting couplers comprising the first reflecting coupler.

23. A system as recited in claim 22, wherein the light sources are arranged in an array, and the reflecting couplers and optical fibers are disposed in respective arrays to match the light source array.

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24. A system as recited in claim 22, wherein the reflecting couplers are formed in a sheet of material, the material of the sheet comprising the body.

25. A system as recited in claim 22, wherein the fibers of the plurality of fibers are bundled together and have outputs at an illumination unit.

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26. A system as recited in claim 22, further comprising a power source coupled to supply power to the plurality of light source.

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27. A reflecting coupler, comprising:

a sheet of material having an aperture extending therethrough from a first surface of the sheet to a second surface of the sheet, a first aperture edge at the first surface of the sheet defining a first perimeter shape having a first number of sides and a second aperture edge at the second surface of the sheet defining a second perimeter shape having a second number of sides, the first number of sides being different from the second number of sides, the aperture having an interior reflective surface extending between the first and second aperture edges.

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28. A coupler as recited in claim 27, wherein the first perimeter shape is rectangular and the second perimeter shape is circular.

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29. A coupler as recited in claim 27, wherein a first portion of the interior reflective surface conforms to a 2-D surface and a second portion of the interior reflective surface conforms to a 3-D surface.

30. A coupler as recited in claim 29, wherein the first perimeter shape comprises linear sides and the interior reflecting surface proximate the first aperture edge conforms to 2-D surfaces, each 2-D surface terminating at a respective linear side of the first perimeter edge.

5 31. A coupler as recited in claim 30, wherein the 2-D surfaces comprise at least a pair of opposing 2-D surfaces that conform to an aspheric cylinder.

32. A coupler as recited in claim 31, wherein the aspheric cylinder is a parabolic cylinder.

10 33. A coupler as recited in claim 29, wherein a reflector axis is defined between the first and second sides of the cylinder, along the center of the aperture, and at least one of the 2-D surfaces is formed with respect to a 2-D surface axis.

15 34. A coupler as recited in claim 33, wherein the 2-D surface axis is coincident with the reflector axis.

35. A coupler as recited in claim 33, wherein the 2-D surface axis is non-coincident with the reflector axis.

20 36. A coupler as recited in claim 29, wherein the second perimeter shape is circular and the interior reflecting surface proximate the second aperture edge conforms substantially a surface of revolution.

25 37. A coupler as recited in claim 36, wherein the surface of revolution is a paraboloid.

38. A coupler as recited in claim 29, wherein the 2-D surface and 3-D surface are interleaved.

39. An optical system, comprising:

a first reflecting coupler disposed generally along a reflector axis, and formed from a sheet of material having an aperture extending therethrough from a first surface of the sheet to a second surface of the sheet, a first aperture edge at the first side of the sheet defining a first
5 perimeter shape having a first number of sides and a second aperture edge at the second side of the sheet defining a second perimeter shape having a second number of sides, the first number of sides being different from the second number of sides, the aperture having an interior reflective surface extending between the first and second aperture edges;

a first light source disposed proximate the first aperture edge; and

10 a first optical fiber having an entrance face disposed proximate the second aperture edge.

40. A system as recited in claim 39, wherein the light source is a light emitting diode.

41. A system as recited in claim 39, further comprising a plurality of light sources directing light into a plurality of respective optical fibers via a plurality of respective reflecting couplers, the plurality of light sources comprising the first light source, the plurality of optical fibers comprising the first optical fiber and the plurality of reflecting couplers
20 comprising the first reflecting coupler.

42. A system as recited in claim 41, wherein the light sources are arranged in an array, and the reflecting couplers and optical fibers are disposed in respective arrays to match the light source array.

43. A system as recited in claim 41, wherein the fibers of the plurality of fibers are bundled together and have outputs at an illumination unit.

44. A system as recited in claim 41, further comprising a power source coupled to
30 supply power to the plurality of light sources.